

Development and Quality Evaluation of Khakhra Incorporated with Dehydrated Amaranth Powder

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ABSTRACT

Introduction

Green leafy vegetables (GLVs) are known to be inexpensive rich sources of micronutrients such as Vitamin A, Iron, β -carotene, etc. and utilizing them is one way of ensuring the micronutrient intake. Dehydration is one of the traditional methods of preservation, which converts the food into light weight, easily transportable and storable product.

Objectives

A study has been undertaken to develop khakhra by incorporating dehydrated Amaranth Leaves Powder (ALP) at different levels.

Methodology

The method of khakhra preparation was standardized and developed at 3 variation adding 5%, 8%, 10% of ALP. The developed products were subjected to sensory evaluation by 30 semi trained panelist using a 9 point hedonic scale.

Results

Results of sensory analysis revealed that products incorporated with 5% dehydrated greens were similar to control in texture, taste and overall quality. However, acceptability scores reduced with increasing concentration of greens.

Conclusion

Amaranth leaves powder incorporated products developed in this study were acceptable by people and can be a daily use snacks which will help community to maintain a healthy life. Better taste and superior nutritive value of khakhra added with ALP justifies as high consumer acceptability.

Keywords: Dehydration, Amaranth leaves powder, khakhra, Variations, Sensory, Incorporated, Developed

INTRODUCTION

In this context, GLVs being inexpensive, affordable, sustainable and culturally acceptable and fit very well into the routine diet and can serve as a means to address these micronutrient deficiencies. Further, GLVs provide several other components that function as antioxidants, primary among them are fiber, β -carotene, ascorbic acid vitamin E, selenium and flavonoids. These offer protection against many life style related chronic diseases viz., heart diseases, obesity, diabetes, hypertension and certain type of cancers. Green leafy vegetables also provide a

variety of phytonutrients - leutin and zeaxanthin which protect our cells from damage and age-related problems. Since many degenerative human diseases have been recognized as being a consequence of free radical damage, there have been many studies undertaken to realize how to delay or prevent the onset of these diseases. Micronutrient deficiencies specially Vitamin A (VAD) and iron (IDA) are the major nutritional problems of India. As Gopalan rightly puts it, food approach is excellent strategy to combat nutritional deficiencies and is superior to pharmacological approach as the former provides a package of nutrients and health promoting components like fiber, unlike

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Received date: December 29, 2020; **Accepted date:** August 27, 2021; **Published date:** September 7, 2021

Citation: Mahalakshmi M (2021) Development and quality evaluation of khakhra incorporated with dehydrated amaranth powder. J Nutr Food Sci. 11:p086

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sole nutrients in the latter (Gopalan, 1986) . The most likely and practical way to fight these degenerative diseases are to improve antioxidant status, which could be achieved by higher consumption of vegetables and fruits.

Foods from plant origin usually contain natural antioxidants that can scavenge free radical (Zhang et al, 2001; Alia et al, 2003). Epidemiological evidence has clearly shown that diets based on fruits and vegetables, with high content of natural antioxidants, contribute to reduced mortality from cardiovascular and cerebrovascular diseases, although their protective effect on cancer risk is less conclusive (Alia et al, 2003). The high fiber, magnesium and low glycaemic index of green leafy vegetables are valued for persons with type II diabetes. Green leafy vegetables are highly perishable with shelf-life of only few days owing to higher amount of moisture due to which around 30 per cent of the produce gets rotten and spoilt, becomes inedible, rendering wastage of a huge amount of nutritious products. This calls for preservation and processing to prevent losses as well as make them available in the lean season at remunerative prices. Vegetables can be processed and preserved by various methods among which dehydration is considered to be an inexpensive and imparting properties that are unmatched by any other preservation techniques. Drying is one of the traditional methods of preservation, which converts the vegetables into light weight, easily transportable and storable product. Advantage of this method is that the vegetable can be easily converted into fresh like form by rehydrating it and can be used throughout the year. In addition to increasing variety in the menu, reducing losses, labor and storage space, dehydrated vegetables are simple to use and have longer shelf-life than fresh vegetables (along with concentration of nutrients. (Chauhan and Sharma, 1993). The quality of the dehydrated product in terms of rehydration ratio, color and flavor retention depends on the pre treatments and method of drying. Major objective of dehydration is to remove moisture as quickly as possible at a temperature that does not seriously affect flavor, texture and color of the food. Drying can be accomplished by a number of traditional and advanced techniques. Sun and oven drying are conventional heating methods where transfer of thermal energy from the product surface towards their centre is slow. Moreover sun drying cannot be employed all through the year and at all places. Shade drying though maintains better quality takes many days to dry to constant weight. Inclusions to this list of traditional methods are spray drying, fluidized bed, kiln, cabinet and microwave oven drying. (Gopalan, 1996).

The process of dehydration, heat application result in changes in the quality specially, the concentration of nutrients, sensory changes like color, texture and flavor. It is essential to test the quality of processed produce to ensure the utilizability for nutritional benefit. In order to enhance the shelf life of green leafy vegetables and to augment the availability throughout the year study has been carried out for dehydration of selected leafy vegetables after different treatments like blanching, sulphitation, blanching + sulphitation. Dehydrated amaranth leaves powder are incorporated in the khakhra to increase the nutritional value. The main focus was for diabetic people, pregnant women and for people who do not have time to eat healthy snacks.

Khakhra is a thin cracker common in the Gujarati and Rajasthancuisines of western India, especially among Jains. It is made from mat bean, wheat flour and oil. It is served usually during breakfast. Khakhra is a thin cracker or a flattened poppadom, which is a Gujarati staple and is usually served as breakfast with a hot cup of tea. Each khakhra is individually handmade and roasted to give the extra crunch and flavour. As a convenient snack it is popular during travels because it does not require any further processing at the point of consumption, need minimal packaging and has long shelf-life. A nutritious Indian diet snack. Very crispy, crunchy, mouthwatering tasty nutritious and very light in weight snack. Favorite among children and teenagers. Available in many different flavors. It is usually eaten with coffee, tea, chutney, pickles, butter, ghee, topped vegetable, cheese or yoghurt

Easy to carry and most of the people of Gujarat carry these as snack during travel. With this background the study has been undertaken to develop and evaluate khakhra incorporated with dehydrated amaranth powder.

METHODOLOGY

AIM

Development of khakhra using dehydrated amaranth powder.

OBJECTIVES

- To standardize dehydrated amaranth leaves powder preparation.
- To standardize khakhra using ALP.
- To subject the developed value added product for sensory evaluation to study the acceptability.
- To subject the standardized khakhra for proximate chemical analysis.

AREA OF INTEREST

In this present generation where the main preference of the day to day life goes to unhealthy snacks and junk, the main focus of the development of this product was to substitute the healthy khakhra over the commercially available chips etc. khakhra can served as a breakfast too. The main focus was for diabetic people, pregnant women and for people who do not have time to eat healthy snacks.

PLAN OF WORK

- Selection of good quality raw ingredients from wholesale market to make the product more affordable and more nutritious.
- Processing of product through a suitable method like sun drying.
- Development of variants of khakhra by carrying out trials in labortary.
- Sensory evaluation of developed products for acceptability by panel of judges.
- Rating and selecting the best variants.
- Conducting the proximate chemical analysis of various nutrients of the standardized food products.

- Budgeting, packing and marketing of the developed products.

PLACE OF STUDY

The experiments are carried out at the Department of Food and Nutrition and Research Centre, Smt V.H.D Central Institute of Home Science (Autonomous), Bengaluru. Sensory evaluation of developed product were carried out in the college Food and Nutrition labrotary.

DEVELOPMENT OF KHA KHRA USING ALP

Khakhra being a roasted product which is a good accompaniment and ready to eat. The control was the plain khakhra which has only wheat flour and besan as the main ingredient. Hence incorporation of Amaranth Leaves Powder was being done to increase the nutritional value.

A) RAW MATERIALS REQUIRED FOR THE DEVELOPING KHA KHRA WITH NATURAL INGREDIENTS

Wheat flour , Bengal gram flour, Amaranth leaves powder, Milk, Jeera, Turmeric powder, Red chilly powder, Salt , Oil. All the raw ingredients were purchased from Vijayanagar Market which is located in Vijaynagar. The ingredients purchased and used were of good quality.

B) METHODS OF PROCESSING

The method used in the development of the product is experimental. Various trials have been carried out with different variations. The products were then compared with the trials. A total of 3 variations were developed and studied. Each variation had different percentage of Amaranth leaves Powder added to the basic. Sensory evaluation was done by a panel of 30 members using a 9 point hedonic scale and the results were tabulated. Based on the results and over all acceptance (5% of Amaranth Leaves Powder) was selected and standardized with appropriate packing, nutritional labelling, shelf life studies, budgeting and marketing.

C) DEVELOPMENT OF THE PRODUCT

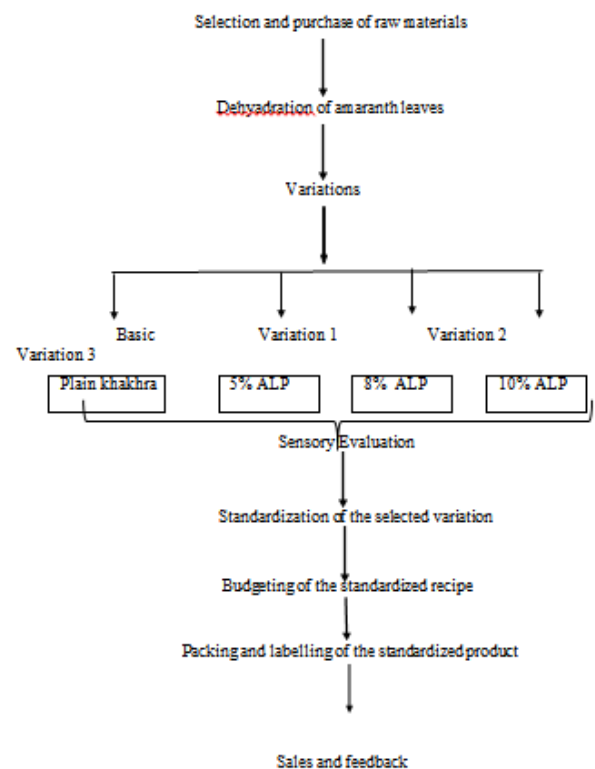


Figure 1. Flow chart for the development and preparation of Amaranth leaves powder incorporated in khakhra

PREPARATION OF AMARANTH LEAVES POWDER

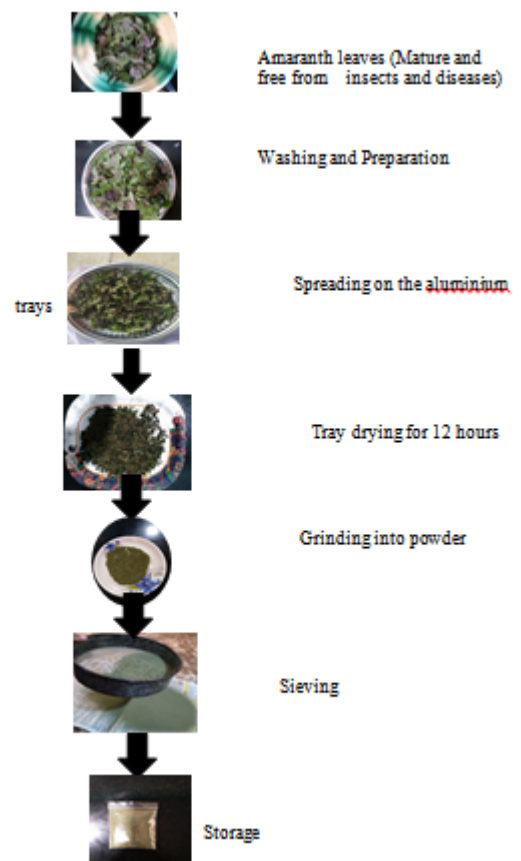


Figure 2. Flow chart for the development and preparation of Amaranth Leaves Powder

The following dehydration technique can be used for dehydration of GLVs and iron security at household level:

- Collect the fresh leaves and remove the stems and other unwanted parts from green leafy vegetables.
- Wash the leaves with slightly warm water to remove the dirt particles. Drain out the excess water from leaves.
- Blanch the leaves (enclosed in muslin cloth) in a stainless steel pan for 2 minutes at 80°C and dry them by following suitable and available technique.
- After blanching and air drying for few minutes put on filter paper. Place the trays at place where adequate area of sun light is available. Solar drying can be used for the drying of green leafy vegetables.
- Dehydrated GLVs is packed in low density polyethylene bags and in air tight aluminum containers for future use.

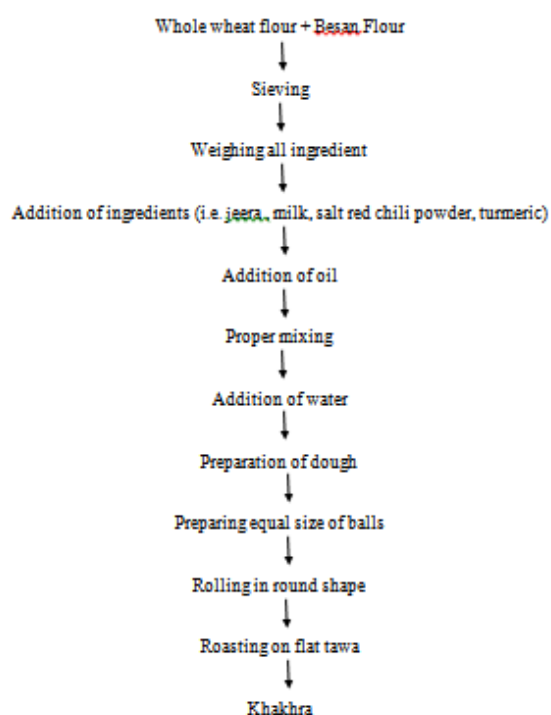


Figure 3. Flow chart for the development and preparation of khakhra

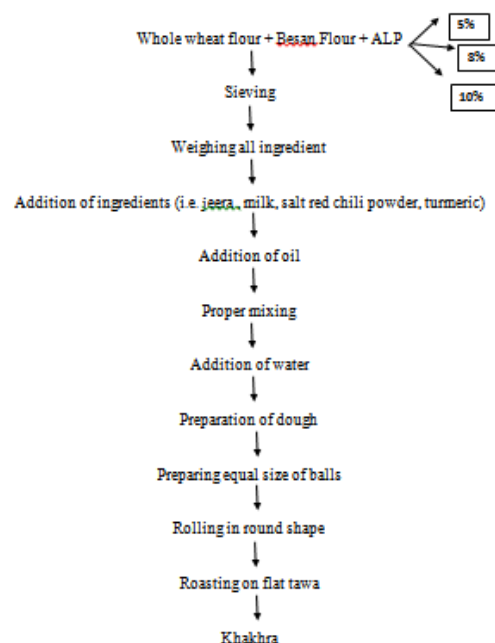


Figure 4. Flow chart for the development and preparation of incorporation of Amaranth leaves powder (ALP)

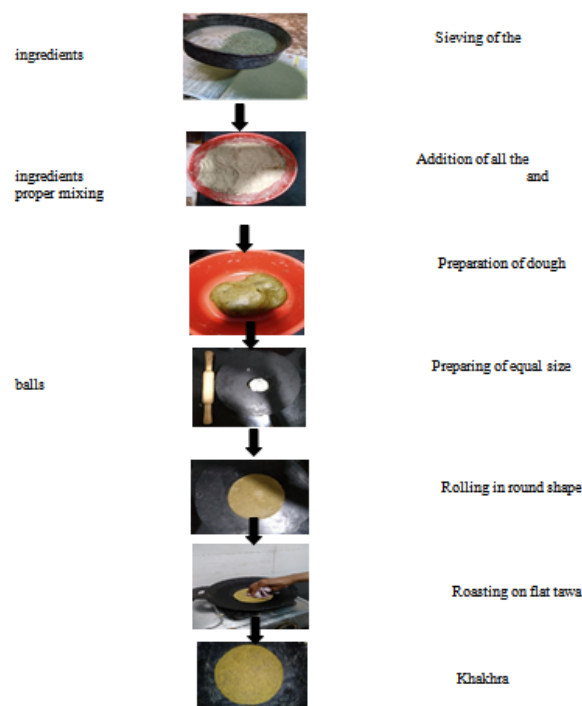


Figure 5. Flow chart for the development and preparation of amaranth leaves khakhra

Wheat flour, Besan flour, ALP and other ingredients were used in the above mentioned amounts and mixed properly to make dough. This dough was then divided into small balls and was rolled evenly to make very thin khakhra of 8-10 cm diameter. 8-10 khakhra were developed using 100g of raw material. The khakhra were then roasted on medium flame for 2 minutes each and were packed in an air tight container.

VARIATIONS

Three different variations were performed along with basic. The variations are made using different proportions of Amaranth leaves Powder incorporated in the khakhra.

| Ingredients | Basic | Variation 1 | Variation 2 | Variation 3 |
|-------------------|-------|-------------|-------------|-------------|
| A.L.P | - | 5% | 8% | 10% |
| Wheat flour | 50% | 50% | 42% | 45% |
| Besan flour | 20% | 15% | 15% | 15% |
| Milk | 5% | 5% | 5% | 5% |
| Jeera | 5% | 5% | 5% | 5% |
| Turmeric powder | 1.25% | 1.25% | 1.25% | 1.25% |
| Red chilly powder | 2.50% | 2.50% | 2.50% | 2.50% |
| Salt | 1.25% | 1.25% | 1.25% | 1.25% |
| Oil | 15% | 15% | 15% | 15% |

Table 1. Composition of different variations of khakhra

SENSORY EVALUATION OF AMARANTH LEAVES KHA KHRA

Sensory evaluation was done to find the acceptability of the Amaranth leaves khakhra using 9 point hedonic scale. Various characteristics like appearance, colour, texture, taste, odour, and over all acceptability were scored from a rating 9 to 1. The ranks were categorized as

- 9 – Like Extremely
- 8 – Like very much
- 7 – Like Moderate
- 6 – Like Slightly
- 5 – Neither like nor dislike
- 4 – Dislike Slightly
- 3 – Dislike Moderately
- 2 – Dislike Very Much
- 1 – Dislike Extremely

Sensory evaluation was performed by semi trained panel members using 9 point hedonic scale and results were tabulated. Using 9 point hedonic scale the variations were evaluated. Of the 3 variations one was selected which got the highest score.

NUTRITIONAL COMPOSITION OF AMARANTH LEAVES KHA KHRA

The developed product and best accepted product was subjected to nutrition quality analysis using standard procedures. The parameters like protein, fat, ash, crude fiber were analysed and the carbohydrate content was calculated by difference method.

PACKAGING AND LABELLING OF THE PRODUCT

Transparent sheets were used as packaging material. It is an acceptable food graded packaging material. It prevents damage from external source, its outer plastic lining helps reduce atmospheric humidity to damage the product therefore preventing degradation of the product that is used to preserve.

Nutritional labelling is information found on the labels of pre-packaged foods.

The purpose of nutritional labelling is to provide the information you need to make healthy choices about the food you eat. The legislated information includes:

- The nutritional facts table – which gives information about the nutritional benefits and calorific value, total fats, total carbohydrate, fibre, proteins, vitamins and minerals of the product.
- The ingredients list – is a list used to make the product which helps in identifying the food products involved .
- Some optional nutrition claims there are added preservatives or whether it is 100% natural.

BUDGETING

Budgeting is critical factor to attain economic success. The budget was finalized for the product with 100g of Amaranth leaves Khakhra for Rs.25 .

| Ingredients | Quantity (g) | Price (Rs) |
|-------------------|--------------------|------------|
| | (for 100g khakhra) | |
| Wheat flour | 50 | 1.94 |
| Bengal gram flour | 15 | 1.08 |
| Amaranth leaves | 5 | 0.54 |
| Jeera | 5 | 2.25 |
| Milk | 5 | 0.22 |
| Red chilly powder | 2.5 | 0.72 |
| Turmeric powder | 1.25 | 0.3 |
| Salt | 1.25 | 0.03 |
| Oil | 15 | 1.2 |

| | |
|---|-------|
| Total ingredient cost per 100g of raw ingredients | 8.28 |
| Overhead charges (labour-20% + markup-60%) | 14.89 |
| Packaging material cost | 5 |
| Label charges | 5 |
| Cost of 100g of final product | 24.89 |

Budgeting of standardized Amaranth Leaves Khakhra

Total cost was calculated and plus 60% profit was incorporated along with packaging and labeling charges. The cost of 100g (8 Khakhra) of final product is Rs.24.89/- which was rounded off to Rs 25. 8 Khakhra's were sold at Rs. 25/-.

STATISTICAL ANALYSIS

The data includes mean scores for each samples tested by the panel members. The results of the sensory evaluation were individually subjected to determine the difference of mean scores of the appearance, colour, texture, flavor, taste and over all acceptability. The results of nutrient composition analysis were tabulated and applied suitable statistical methods.

RESULTS AND DISCUSSION

In this research khakhra was made by the incorporation of amaranth leaves powder in the proportion of 5%, 8% and 10% . Dehydrated leafy vegetables are concentrated source of several nutrients including iron and β -carotene. Sensory evaluation was done to check acceptance of the products using nine point hedonic scale by 30 semi-trained panel members.

The results pertaining to the research were discussed below.

PRELIMINARY TRIALS

Different preliminary trials were carried out to prepare Khakhra with natural ingredients to observe the sensory attributes such as appearance, colour, flavor and texture.

| TRIALS | INGREDIENTS | DESCRIPTIVE PROFILE OF AMARATH LEAVES KHAHRA |
|---------|--|--|
| CONTROL | Wheat flour - 50% , Besan flour - 20% Oil - 15% , Jeera Powder - 5% , Turmeric Powder - 1.25% , Red chilly powder - 2.5% , Salt - 1.25% , Milk - 5% | Light yellow, perfectly cooked, good texture |

| | | |
|---------------|--|--|
| VARIATION I | Wheat flour - 50% , Besan flour - 15% Amaranth Leaves Powder - 5% , Oil - 15% , Jeera Powder - 5% , Turmeric Powder - 1.25% , Red chilly powder - 2.5% , Salt - 1.25% , Milk - 5% | Light green colour, perfectly cooked, crispy texture |
| VARIATION II | Wheat flour - 42% , Besan flour - 15% Amaranth Leaves Powder - 8% , Oil - 15% , Jeera Powder - 5% , Turmeric Powder - 1.25% , Red chilly powder - 2.5% , Salt - 1.25% , Milk - 5% | Light green colour, perfectly cooked, crispy texture |
| VARIATION III | Wheat flour - 45% , Besan flour - 15% Amaranth Leaves Powder - 10% , Oil - 15% , Jeera Powder - 5% , Turmeric Powder - 1.25% , Red chilly powder - 2.5% , Salt - 1.25% , Milk - 5% | Dark green colour, cooked, crispy texture |

Table 3 - Variations carried out during development of Amaranth Leaves Khakhra

VARIATIONS

Composition and proportions of various ingredients used in the variations

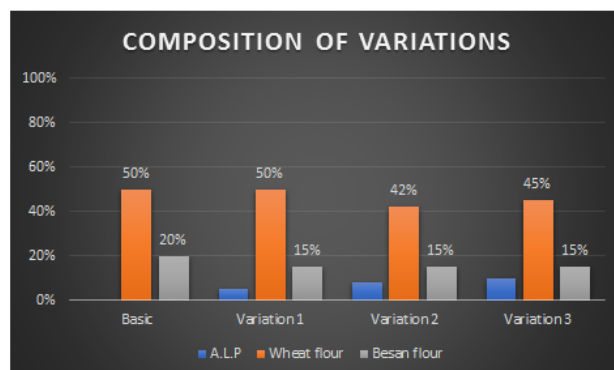


Figure 6 - Composition of variations

Three different variations were performed along with basic. The variations are made using different proportions of Amaranth leaves Powder incorporated in the khakhra. Variation I was made using 5% incorporation of amaranth leaves powder and

other ingredients were kept in same proportion. Variation II was made using 8% incorporation of amaranth leaves powder. Variation III was made using 10% incorporation of amaranth leaves powder.

SENSORY EVALUATION OF DEVELOPED PRODUCTS

APPEARANCE

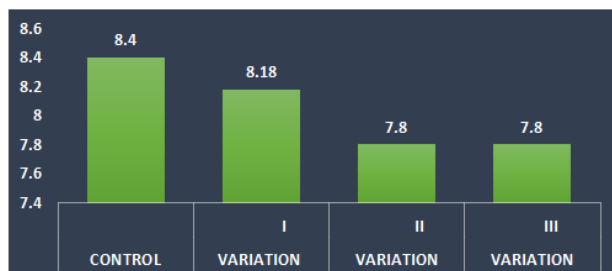


Figure 7. Mean Scores of Appearance

The products were evaluated for sensory qualities. The results showed that Variation I was best selected for appearance compared to Variation II and III. The other 2 variations were not accepted as they do not looking as compared to Variation I.

COLOUR

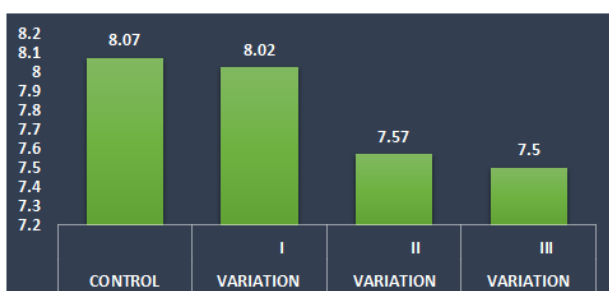


Figure 8. Mean Scores of Colour

The products were evaluated for sensory qualities. The results showed that Variation I was best selected for colour attribute compared to Variation II and III. 8% and 10% appeared to be more darker in colour due to increased proportion of ALP and they were not accepted as as compared to variation I.

TEXTURE

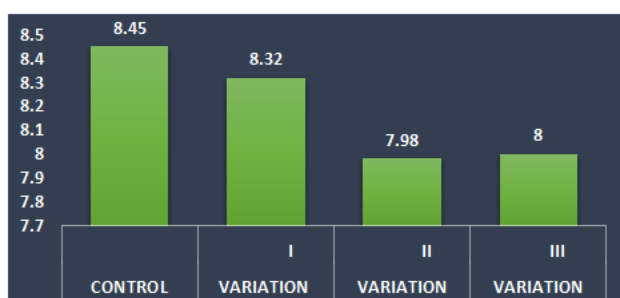


Figure 9. Mean Scores of Texture

The products were evaluated for sensory qualities. The results showed that Variation I was best selected for texture attribute compared to Variation II and III. They tend to be more crisp than Variation II and III. Variation III was compared to crispier than variation II.

TASTE



Figure 10. Mean Scores of Taste

The products were evaluated for sensory qualities. The results showed that Variation I was best selected for taste attribute compared to Variation II and III. Variation II and III have the same taste even though the proportion is different.

ODOUR



Figure 11. Mean Scores of Odour

The products were evaluated for sensory qualities. The results showed that Variation I was best selected for taste odour compared to Variation II and III. Variation II and III have similar taste even though the proportion is different.

OVER ALL ACCEPTABILITY



Figure 12. Mean Scores of Overall Acceptability

The products were evaluated for sensory qualities. Overall Variation I was equally accepted with basic. Variation II was

ranked in second place due to incorporation of 8% of ALP and Variation III was ranked in third place due to incorporation of 10% ALP.

SENSORY EVALUATION OF DEVELOPED PRODUCTS

| ATTRIBUTES | | SAMPLES | | | |
|------------------------|----------|----------|------------|------------|------------|
| | | CONTR OL | VARIATI ON | VARIATI ON | VARIATI ON |
| | | | I | II | III |
| Appearance | Mean | 8.4 | 8.18 | 7.8 | 7.8 |
| | SD | 0.77 | 0.59 | 0.85 | 0.89 |
| | F - Test | 0.17 | 0.06 | 0.81 | 0.45 |
| Colour | Mean | 8.07 | 8.02 | 7.57 | 7.5 |
| | SD | 0.83 | 0.68 | 0.77 | 0.82 |
| | F - Test | 0.28 | 0.47 | 0.76 | 0.96 |
| Texture | Mean | 8.45 | 8.32 | 7.98 | 8 |
| | SD | 0.56 | 0.84 | 0.95 | 0.87 |
| | F - Test | 0.04 | 0.49 | 0.64 | 0.02 |
| Taste | Mean | 8.4 | 8.27 | 7.33 | 7.33 |
| | SD | 0.72 | 0.78 | 1.3 | 1.12 |
| | F - Test | 0.67 | 0.01 | 0.45 | 0.02 |
| Odour | Mean | 8.23 | 8.13 | 7.2 | 7.3 |
| | SD | 0.57 | 0.73 | 1.56 | 0.95 |
| | F - Test | 0.18 | 0 | 0.01 | 0.01 |
| Over all acceptability | Mean | 8.33 | 8.3 | 7.55 | 7.53 |
| | SD | 0.61 | 0.6 | 0.62 | 0.82 |
| | F - Test | 0.93 | 0.83 | 0.14 | 0.11 |

Table 4

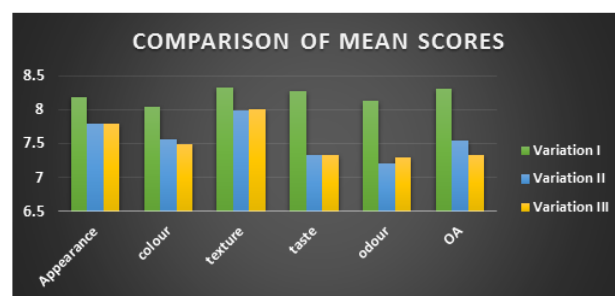


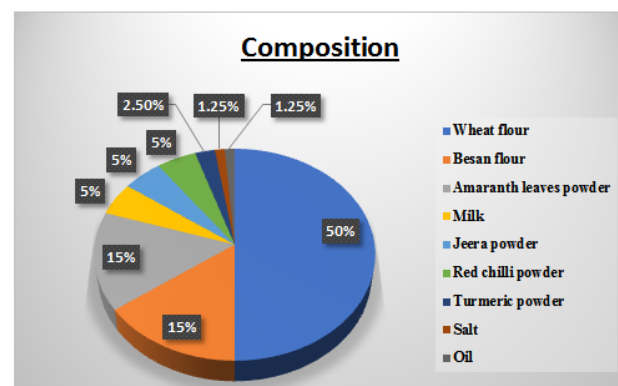
Figure 13. Comparison of Mean Scores of the three variations of Amaranth leaves Khakhra

STANDARDIZATION OF AMARANTH LEAVES KHAKHRA

After the sensory evaluation an statistical analysis of all the variations, the best product was chosen for standardization. Among four variation, variation 1 was rated best and was subjected to standardization.

| INGREDIENTS | QUANTITY |
|------------------------|----------|
| Wheat flour | 50g |
| Besan flour | 15g |
| Amaranth leaves powder | 5 g |
| Milk | 5ml |
| Jeera powder | 5g |
| Red chilli powder | 2.5g |
| Turmeric powder | 1.25g |
| Salt | 1.25g |
| Oil | 15ml |

Table 5. Composition of Amaranth Leaves Khakhra



NUTRITIONAL COMPOSITION OF THE BEST ACCEPTABLE PRODUCT

CALCULATED VALUES

| Ingredients | Qty | Energy | Protein | Fat | Fibre | Iron | Ca | Vit - A |
|-------------------|--------|--------|---------|------|-------|------|------|---------|
| | (g/ml) | (Kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) |
| Wheat flour | 50 | 160.1 | 5.29 | 0.77 | 5.68 | 2.05 | 15.4 | 1.34 |
| Bengal gram flour | 15 | 43 | 2.8 | 0.7 | 3.7 | 1.02 | 22.5 | 4.3 |
| Amaranth Leaves | 5 | 1.53 | 0.16 | 0.03 | 0.22 | 0.23 | 16.5 | 71.2 |
| Oil | 15 | 135 | - | 15 | - | - | - | - |
| Milk | 5 | 3.65 | 0.16 | 0.22 | - | 0.01 | 5.9 | 0.11 |
| Total | | 343.2 | 8.41 | 16.7 | 9.6 | 3.31 | 60.3 | 76.9 |

The above calculated values are for 100g of the product which yield 8 khakhra. Calcium value was obtained around 60.3 mg and vitamin A value around 76.9 mg. As it is consumed as a snack calcium content can be considered high. The fibre content is also high and can be given to pregnant ladies as a snack.

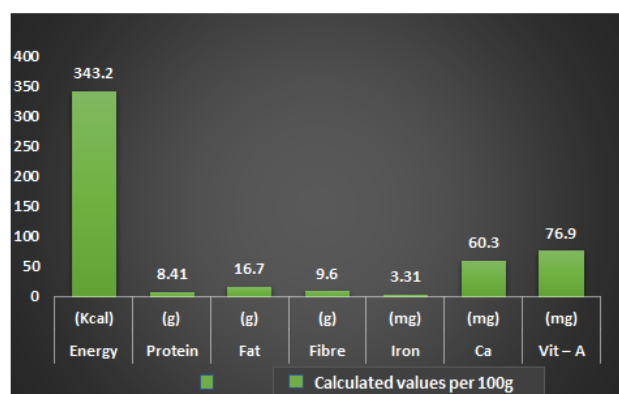


Figure 15. Calculated nutritional composition of the standardized product

ANALYSED VALUES

Nutritional composition of the standardized Amaranth Leaves Khakhra was determined by conducting proximate analysis of final standardized product which was conducted at IADFAC (Institute of Analysis of Dairy, Food and Culture) Laboratory.

| Nutrients | Values per 100g |
|-------------------|-----------------|
| Energy (kcal) | 403.3 |
| Carbohydrates (g) | 71.7 |

| | |
|-----------------|-------|
| Protein (g) | 13.95 |
| Fat (g) | 6.75 |
| Crude fibre (g) | <0.1 |
| Calcium (mg) | 320.7 |
| Moisture (g) | 1.31 |
| Total ash (g) | 6.29 |

Table 7: Analysed Nutritional Composition of the Standardized Product

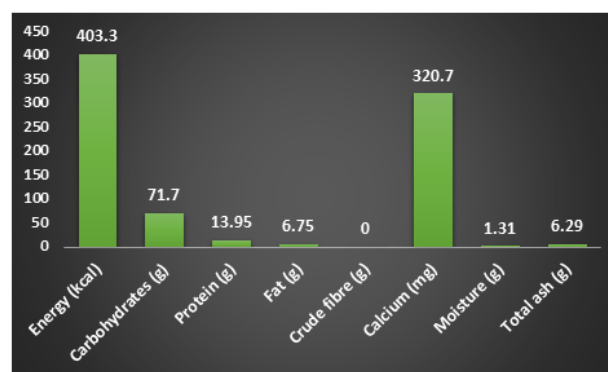


Figure 16. Analysed nutritional composition of the standardized product

SUMMARY

The research on “ Development and Quality Evaluation Of Khakhra incorporated with Dehydrated Amaranth Powder ” has been under took with an objective to standardize dehydrated amaranth leaves powder preparation and standardize khakhra using ALP. Various trials have been carried out with different variations. The products were then compared with the trials. A total of 3 variations were developed and studied. Each variation had different percentage of Amaranth leaves Powder added to the basic.

The products were subjected to sensory evaluation, based on the results the best products were further taken for nutritional composition.

The salient features of the research were given below :

- Amaranth Leaves Powder were incorporated in the khakhra to increase the nutritional value. These can be given to pregnant women as a healthy snacks.
- Sensory evaluation was done to find the acceptability of the Amaranth leaves khakhra using 9 point hedonic scale. Various characteristics like appearance, colour, texture, taste, odour, and over all acceptability were scored from a rating 9 to 1.
- Mean of all the variations were compared. Out of the three Variations, Variation I was best accepted for all the attributes.
- It was found that the chemical composition contain 343.2 Kcal of energy, 8.41g of protein, 16.7g of fat, 9.6g of fibre, 3.31mg of iron, 60.3mg of Calcium, 76.9mg of Vitamin -A.

- After standardization of the product it underwent a series of process like packaging, labelling and budgeting of the product and the finalized product was sold at Rs 25/- for 100g.

The products were subjected for sales on the day of the exhibition.

CONCLUSION

Dehydrated leafy vegetables are concentrated source of several nutrients including iron and β -carotene. Development of the products by incorporation of the dehydrated GLVs in traditional preparations can assist to meet the daily nutritional requirements of the adolescent girls.

The addition of Amaranth leaf powder to the khakhra had a significant effect on their quality attributes. The nutrient content of the snacks was significantly improved by the addition of Amaranth leaf powder. Amaranth leaves powder incorporated products developed in this study were acceptable by people and can be a daily use snacks which will help community to maintain a healthy life. Better taste and superior nutritive value of khakhra justifies its high consumer acceptability. On the basis of results, it could be concluded that Variation I is best accepted. After the preparation of value added khakhra it was packed in high barrier vacuum pouches. Then the physico-chemical properties were evaluated containing different various parameters. However, there is a need to improve the sensory quality of Amaranth-enriched snacks through education of consumers about the role of Amaranth on nutrition and health-promoting benefits of the snacks.

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